Fiscal Year 1999 Research Program of the Integrated Data Systems Laboratory

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ABSTRACT

In FY99, the Mississippi State University (MSU) Integrated Data Systems Laboratory of the Engineering Research Center for Computational Field Simulation (ERC/IDSL), formerly the MSU Center for Air Sea Technology (CAST) until 1 July 1999, conducted research under several grants and contracts from a variety of governmental sources. This document reports on ERC/IDSL performance in these areas of:

- Advanced Development of the Master Environmental Library (MEL) System under Naval Research Laboratory Contract N00173-98-C-6012;
- Data Distribution via the Master Environmental Library (MEL) for Navy Surf Zone Operations under Naval Research Laboratory Contract N00173-98-C-6012;
- Master Environmental Library Implementation for a National Ocean Partnership Program Gulf of Mexico Ocean Monitoring System under NASA-Stennis Space Center Contract NAS13-98033 Delivery Order 13;
- Development and Maintenance of the Naval Interactive Data Analysis System (NIDAS) for the Naval Oceanographic Office and Commander Mine Warfare Command under NASA-Stennis Space Center Contract NAS13-98033 Delivery Order 23;
- Development of an Environmental Data Infrastructure for the Gulf of Mexico under Environmental Protection Agency/Gulf of Mexico Program Office Contract MXS984100-97-0;
- Development of Metadata Collection Software in the JAVA Programming Language under U.S. Geological Survey Contract P098HQSA2002 99030279;
- Establishing a National Geospatial Data Clearinghouse Node at the ERC/IDSL under U.S. Geological Survey Contract 98HQAG2131 98080711; and
- A Distributed Data Warehouse for the Remote Sensing Technologies Center under NASA-Stennis Space Center Contract NCC1399001 99070609.

Finally, this report summarizes ERC/IDSL FY99 proposals submitted and contracts awarded, participation in interdisciplinary activities, recognition and awards, publications, presentations and demonstrations, offices held, sponsored seminars, and other workshops and meetings attended.

The opinions, findings, conclusions, and recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the U.S. Government. No official endorsement should be inferred.

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1.0 INTRODUCTION

The Mississippi State University's (MSU) Engineering Research Center's Integrated Data Systems Laboratory (ERC/IDSL), formerly the MSU Center for Air Sea Technology (CAST), evolved from the Institute for Naval Oceanography's (INO) Experimental Center for Mesoscale Ocean Prediction (ECMOP) which began in 1989. MSU CAST began operation on 1 October 1992 and continued in that capacity until it was formally merged with the Engineering Research Center on 1 July 1999. This technical report includes CAST operations for the first nine months of FY99, and then as ERC/IDSL, operations for the remaining three months.

As in the past, ERC/IDSL technical research and development has produced tools, systems, techniques, and procedures that improve efficiency and overcome deficiency for both the operational and research communities residing with the DOD, private industry, and the university ocean modeling community. We continue this effort with the following thrust areas:

- Develop advanced methodologies and tools for model evaluation, validation and visualization, both oceanographic and atmospheric;

- Develop a system-level capability for conducting temporally and spatially scaled ocean simulations driven by or are responsive to ocean models, and incorporates the coupling to atmospheric models;

- Develop an oceanographic/atmospheric data management system with emphasis on distributed databases in a network environment, with database optimization and standardization, including use of World Wide Web (WWW);

- Implement a high performance parallel computing technology for ERC/IDSL ocean models; and

- Implement new software applications and systems into a distributed object computing environment utilizing government and industrial standards such as CORBA (Common Object Request Broker Architecture).

The ERC/IDSL approach employs the most recent technological advances in database management, graphics/visualization, and network communications including the WWW. ERC/IDSL deliverables include:

- Implementation of a laboratory-like capability for oceanographic and atmospheric model evaluation and validation that incorporates measurements of performance skill;

- Development of high resolution coastal models based on DieCAST;

- An economical data access solution and distributed database capability for networked database users, including DOD components;

- New model visualization and animation tools for analyzing and assessing model output; and

- Implementation of network file browsing capability and use of the WWW for general database access and educational applications.

This document reports on the results of the research conducted in FY99. In particular, in Section 2.0 we discuss the research conducted with NRL, Section 3.0 with NAVOCEANO, Section 4.0 with EPA, Section 5.0 with the U.S. Geological Survey, and Section 6.0 with NASA at the Stennis Space Center. Section 7.0 provides information on ERC/IDSL current facilities and personnel. This is followed by an Appendix which summarizes for FY99 proposals submitted and contracts awarded, participation in interdisciplinary activities, recognition and awards, publications, presentations and demonstrations, offices held, sponsored seminars, and other workshops and meetings attended.

2.0 RESEARCH PROJECTS WITH THE NAVAL RESEARCH LABORATORY

2.1 Advanced Development of the Master Environmental Library (MEL)

The Defense Modeling and Simulation Office (DMSO) initiated and funded the Master Environmental Library (MEL) project to catalog and distribute key environmental datasets via the INTERNET using current and emerging technologies to support the modeling and simulation of tactical environmental scenarios. This project involves various DOD agencies from the Army, Navy, and Air Force. NRL has been designated by DOD as the lead agency for the MEL Task 2 development, and ERC/IDSL is a subcontractor to NRL for development of the MEL Resource Site (distributed data storage facilities) Software.

The datasets currently available via MEL include environmental parameters from observations, operational numerical models, climatological databases, and others located at various sites across the country. At the core of MEL is a "Library Structure" (MEL/LS) that incorporates the environmental databases at remote sites, a master catalog system, and clients to browse and access data/metadata. The World Wide Web (WWW) over the INTERNET has been identified as the vehicle of choice to implement MEL. The location of the databases and components of the sub-system are transparent to the users. The users can exercise the system remotely using a WWW browser such as Netscape or MS Explorer from a variety of hardware platforms including Unix machines, desktop PCs, and Macintosh computers. From this environment the users can perform queries based on their region and time window of interest for their choice of environmental parameters. No prior knowledge of the location of the databases and their formats is necessary. Once the user identifies a dataset of interest, he/she can submit an automated request for retrieval, which is processed asynchronously. The extracted dataset can be transferred to the user via ftp or email. Also, a subscription mechanism has been implemented to allow the users to subscribe to data products that are routinely generated.

ERC/IDSL, early in FY95, received modest funding from NRL to begin preliminary work on the MEL. A subsequent three-year contract was awarded under NRL Broad Agency Announcement 95-1 and Contract Number N00014-95-C-6032 and the following tasks were accomplished: design, implement, and document the MRSS which was initially known as the MEL/LS Regional Request Handler; the purchase and installation of dedicated MEL hardware

for several resource and developmental sites; the provision of support to various sites and other DMSO sponsored activities such as the Surfzone Project and other training/exercises via MEL; and the survey of other potential MEL users and assisting them in defining their data needs with respect to MEL.

More specifically, MEL resource sites now online include:

-NRL	Monterey, CA
-MSU ERC/IDSL	Stennis Space Center, MS
-Air Force Global Weather Central	Omaha, NE
-Air Force Combat Climatology Center	Asheville, NC
-National Geodetic Data Center	Boulder, CO
-Army Research Laboratory	White Sands, NM
-Army Research Laboratory	Beltsville, MD
-Air Force Phillips Laboratory	Hanscom, MA
-National Imagery and Mapping Agency	Fairfax, VA
-National Imagery and Mapping Agency	St. Louis, MO
-Air Force Simulator Database Facility	Kirkland Air Force Base, WA

The MSU ERC/IDSL site supports the DMSO sponsored Surfzone Project at NRL Stennis Space Center and elsewhere. In addition, the Naval Oceanographic Office participated in testing a prototype version of the MEL Access Site Software to determine special implementation considerations needed at an "operational" vice "research" site.

The following sites have been approved to be part of MEL in the future:

-Naval Oceanographic Office	Stennis Space Center, MS
-Army Topographic Engineering Center	Alexandria, VA

In addition, the following activities have been approved as "candidate sites":

-Army Research Laboratory-Battlefield Environment Directorate	Adelphi, MD
-Seventh Army Training Command Terrain Simulator Center	Grafenwoehr, Germany

The MEL Resource Site Software (MRSS) Version 1.1 was released to all sites, as was a MRSS Administrator's Guide (also known as the MEL Software Center Operator's Manual).

A follow-on contract (N00173-98-C-6012) for Advanced Development of MEL was given to ERC/IDSL that extends and expands our existing research program through FY01. The primary area of research is structured to experiment with Distributed Object Computing (DOC) methodologies and CORBA standards whereby environmental data of all types can be indexed, archived and rapidly disseminated within a DOC network environment. The research will be conducted in a network laboratory setting composed of widely separated data resource nodes located at the major DOD and other Federal centers. ERC/IDSL will perform comparative

studies, design and carry out simulation experiments, and demonstrate advanced capabilities for optimizing the acquisition, storage and distribution of gigabyte/terabyte-size volumes of atmospheric, oceanographic, terrain and near-space environmental information. The major research issues to be addressed are:

- A Restructuring of Research Roles. The primary effort of ERC/IDSL has focused on data resource node capabilities, while NRL has focused on the functionality of a central controlling node. Based on experience, ERC/IDSL will expand its effort by incorporating the central node studies and restructuring the effort to focus on more fundamental research topics.

- Without reliable access to validated data, no model or simulation is capable of demonstrating its intended purpose. The DMSO vision for applying environmental information in defense models and simulations recognizes this dependency on data, specifically rapid and reliable access to data archival and collection centers. This vision also maps well to the technological progress that will enable rapid dissemination of future environmental data to DOD operational forces. To fulfill this vision, ERC/IDSL believes an integrated research effort is necessary – one that examines all aspects of "the data problem". While progress has been made during the past several years, advancing communications and computational technologies serve only to quicken the pace at which new concepts must be studied and analyzed. We will conduct research in three specific thrust areas that address the environmental data requirements of the M&S research community: (1) Advanced Distributed Software Concepts, (2) Experiments in Optimal Environmental Data Access, and (3) Collaborative Research Efforts.

2.2 Data Distribution via the Master Environmental Library (MEL) for Navy Surf Zone Operations

Environmental data is widespread and is stored on a wide variety of storage devices and hardware platforms, each with its own peculiar set of security requirements. In order to simulate the dynamic nature of the surf zone, real time data is required. Surf zone simulations are used by the Navy in amphibious exercises and, to a lesser extent, in mine warfare exercises. Access to the widely distributed data resources required to support simulations has been a persistent problem in the past. MEL was viewed as a potential mechanism to overcome these difficulties.

The research objective was to examine the feasibility of providing real time data to support surf zone simulations, including the ancillary data associated with these simulations. The work also provided a useful testbed for data acquisition and delivery for other purposes via leveraging with the MEL project. Since the procedures for data acquisition via MEL were highly compatible with the needs of the Navy for surf zone simulations, it was considered possible to effectively employ MEL as the vehicle for identifying data and delivering it to the customer.

This project has provided an opportunity to work within a broad range of security restrictions. In some cases, the data has only been accessible using password protected methods. In other cases, the data has been readily available from files via anonymous ftp. Finally, much of the data resides in relational databases, requiring tailored procedures (embedded SQL) to gain

access. The hardware platforms being accessed have ranged from the 16/32-bit PC to the 64-bit Cray C90.

Nearly 100 distinct data sets have been made available for distribution via MEL. These include surf, wave, and atmospheric/ocean model output (wave heights, energy fluxes, wind/current vectors, tidal oscillations, observational data and bathymetries). The spatial resolution ranges between global and microscale, covering the regions of Navy interest.

3.0 RESEARCH PROJECTS WITH THE NAVAL OCEANOGRAPHIC OFFICE

3.1 Master Environmental Library Implementation for a National Ocean Partnership Program (NOPP) Gulf of Mexico Ocean Monitoring System

Oceanographic Data produced under the NOPP Gulf of Mexico Ocean Monitoring System Project is to be made publicly available via the World Wide Web. The Naval Oceanographic Office (NAVOCEANO) is responsible for achieving this capability, and the ERC/IDSL is assisting by making this data publicly available via the Master Environmental Library Resource Site (MEL RS) located at NAVOCEANO. The effort will achieve the objective in an Internet computing environment that supports software design and development, as well as a separate operationally configured MEL RS. ERC/IDSL will also be responsible for software maintenance and NOPP data distribution.

The project involves the following tasks:

- Modifying the existing ERC/IDSL client/server automated data retrieval/transferal software system currently employed for transferal of IPOPS/ISIS data from the HPCC to designated remote sites. This will allow for both scheduled and impromptu transfer of customer-requested NOPP data subsets to the MEL RS site for further distribution via the MEL delivery system. An on line inventory of NOPP data for the most recent ten day period will be maintained. Spatial/temporal subsetting of the datasets will be supported to the extent they are supported by existing data file formats.

- Designing, developing and implementing appropriate MEL compliant data discovery and packaging software including format encoders (GRIB, BUFR, netCDF, etc.) as necessary for compatibility with MEL RS functional capability. We will also create FGDC standard metadata records for all NOPP data holdings made publicly available. ERC/IDSL will perform developmental tasks on a hardware platform to be provided by NAVOCEANO. Fully tested software components/modules will ultimately be migrated to the MEL RS operational hardware platform.

- Maintenance of MEL RS software on a normal working hour basis. During other times, we will rely upon the built-in MEL RS automated recovery capability for all but severe system crashes. These services include development of additional data extraction/retrieval modules, supporting FGDC metadata records, and implementation of delivery mechanisms.

- Installing the MEL Resource Site Software (MRSS) on two separate hardware platforms at NAVOCEANO. The primary platform will support MEL Resource Site operations on a routine basis. The secondary platform will be configured to assume operations on an interim basis when and if the primary platform experiences hardware/software failure.

This project is currently awaiting NAVOCEANO assignment of the hardware platforms on which to implement this software.

3.2 Development and Maintenance of the Naval Interactive Data Analysis System (NIDAS)

The objective of NIDAS is to provide NAVOCEANO with an interactive overlay capability for several types of oceanographic, meteorological, and satellite derived data; create 3-D gridded fields of temperature and salinity profiles constructed from a combination of "provinced" data (user derived) and gridded data; and provide a user's manual and training of NAVOCEANO personnel in the new software system.

Phase I tasks completed in 1994 were to ingest static databases into a ERC/IDSL installed EMPRESS/NEONS system; prepare final design/database specification documents; ingest revolving databases into EMPRESS/NEONS; design and develop additional application programs to provide the capability to interactively view and evaluate the OTIS fields by comparison with other fields; assist NAVOCEANO in interfacing the system to the classified POPS via the LAN to ensure the continuity of NIDAS operational commitments; train NAVOCEANO personnel in system operation; and provide informal monthly demonstrations. Phase II tasks completed in 1995 were to make the system relocatable on short notice to any area of the world of local or regional size. Phase III provided for enhancements and modifications to the system and was also completed in 1995. In FY96, we began providing maintenance and development tasks for NIDAS at both the unclassified and classified levels. In FY97, we were again funded by NAVOCEANO to develop software upgrades to NIDAS to enable NAVOCEANO to better produce databases and products specific to Commander Mine Warfare Command.

For FY98, ERC/IDSL was funded by NAVOCEANO for additional NIDAS development and maintenance at NAVOCEANO, Coastal Systems Station, COMINEWARCOM, and aboard the USS Inchon. Also, new versions of NIDAS were installed and tested at each of these locations. We also developed minor enhancements to the synthetic profile module, volume data applications, IDBMS interfaces, and MIW applications, as well as provided software upgrades for COMINEWARCOM. The final effort was to complete the final documentation for NIDAS3.

NAVOCEANO in late FY98 initiated a patent for NIDAS with the U.S. Patent Office. Developers include Mr. Steve Haeger of NAVOCEANO and ERC/IDSL's Mr. Jim Corbin, Mr. Dharmesh Krishnamagaru, and Mr. Ramesh Krishnamagaru.

For FY99, in response to another NAVOCEANO statement of work, ERC/IDSL completed the following:

- Provided maintenance for approximately ten installations of NIDAS in NAVOCEANO spaces and two installations at COMINEWARCOM.
- Enhanced the "Axes Units" to allow users to specify data units.
- Upgraded NIDAS to implement a capability to list and export to ASCII file including histograms in single tabular form and roses in a bivariate distribution table.
- Assessed the magnitude of the effort to port various pieces of NIDAS to the Windows-NT environment, and draft an analysis report.
- Developed a prototype Windows-NT capability for LLT data with polygon, profile isolation, and export functions.
- As required by NAVOCEANO, all software and data formats were Y2K compliant.

In accordance with the a new FY00 contract, ERC/IDSL will complete the following tasks by 30 June 2000:

- Provide maintenance for approximately ten installations of NIDAS in NAVOCEANO spaces and two installations at COMINEWARCOM.
- Provide an internal database category for sequential observed ocean profiles for editing. These can be transect or synoptic group of profiles (typical grouping of profiles collected from a NAVOCEANO survey).
- Provide the capability to remove spikes, or groups of depth, temperature, salinity from a profile resulting in a "compressed" profile.
- Provide the capability to replace a single or multiple groups of depth, temperature, and salinity with interpolated values. The user will be able to replace either temperature or salinity or both.
- Provide the capability to produce waterfall plots for sequential observed profiles with capabilities specified above.
- Provide the capability to edit the MOODS header fields in Data Warehouse format. The header editor will work interactively with the profile and location plots. Profiles needing to be edited can be selected by scrolling, entering a profile number, or by interactively selecting the profile from the location or the profile window. Scrolling capabilities will be forward or backward in user defined steps.
- Continue to port more of the existing NIDAS capabilities to modules compatible to the DPT modules for the Windows-NT environment.
- Provide histogram capability for a single parameter of observed wave and meteorological data.
- Provide a Data Base Design Document/Software Design Document and a NIDAS User Manual for NIDAS-5 (Windows-NT Version).
- All software and data formats will be Y2K compliant.

4.0 RESEARCH PROJECT WITH THE ENVIRONMENTAL PROTECTION AGENCY

4.1 Development of an Environmental Data Infrastructure for the Gulf of Mexico

The EPA and Gulf of Mexico Program (GMP) are proceeding in a systematic manner to facilitate the preservation of the Gulf ecology. As a first step, GMP has established four focus areas: Nutrient Enrichment, Public Health, Non-indigenous Species, and Habitat. GMP has recognized the need for fast information exchange on these and other related issues as a fundamental means to achieve this goal. ERC/IDSL has been assisting the GMP in the development of an internet-based information infrastructure, and is providing a cost effective and efficient means of information exchange in these four areas among the GMP participants that include government agencies, universities, and other environmental agencies of the five Gulf States.

The ERC/IDSL approach to developing this information infrastructure has been based upon achieving cost efficiency; moderate technical sophistication so that agencies can participate without significant effort or expense; no data storage duplication; ease and efficiency for participation; and finally, as much as possible, leveraging earlier research and development projects.

At present, ERC/IDSL is in the process of completing the development of the Virtual Data Warehouse (VDW). It connects GMP participants via the Internet in a distributed virtual environment so that all can contribute and share information on the four GMP focus areas. It links remotely distributed data sets via a metadata structure, which was formulated in consultation with the GMP Data and Information Transfer Committee (DITC). To make it easier for participants to submit their datasets to VDW, the number of metadata items by design are kept small (about 20), and are compatible with the FGDC format. The metadata provide a proxy at the VDW for the actual data set residing at partner sites. When needed, VDW provides a capability to transfer data sets directly to the user site. This obviates the need for building a vast data storage facility in the GMPO. The complete VDW system was delivered on 30 September 1999.

At present, the VDW system is going through the final enhancements and modifications resulting from Beta Test II. Through December 1999, ERC/IDSL will prepare hardware/software documentation and a users guide for delivery to GMPO.

With funding from the U.S. Geological Survey and GMP, ERC/IDSL has developed a National Spatial Data Infrastructure (NSDI) clearinghouse node. This node allows GMPO to serve its metadata, and that of selected program participants, into the national system in compliance with Executive Order 12906.

ERC/IDSL has proposed several new projects for Calendar Year 2000. One is the Gulf Aquatic Mortality Network (GMNET), identified by GMP as an immediate focus project. ERC/IDSL was funded in 1999 to perform a requirement study on the project, which was completed as a GMNET DBMS Requirements Specification Document. This study forms the basis for DBMS development. The GMNET is a network of public and private sector individuals

and groups, government agencies, and universities organized to enhance the response to and utilize information gained from aquatic (fish) mortality events in the Gulf of Mexico. The development of the GMNET DBMS will proceed through the six phases of (a) Requirements Analysis, (b) Design, (c) Conceptual Prototype and Feedback, (d) Implementation, (e) Test and Feedback Collection, and (f) Documentation and Software Packaging.

Based on the success of the GMNET requirements study, ERC/IDSL will also in CY2000 conduct a similar study for a GMPO Corporate Database Management System (GCDBMS) for storing and accessing data sets in use by the GMPO, which owns many data sets and requires a data archive and retrieval capability.

Finally, we will also assist EPA/GMPO in refining its Gulf Environmental Monitoring Sites (GEMS) information network.

5.0 RESEARCH PROJECTS WITH THE U.S. GEOLOGICAL SURVEY (USGS)

5.1 Development of Metadata Collection Software in the JAVA Programming Language

Under contract to the U.S. Geological Survey, the objective was to develop metadata collection software in the Java programming language that would provide an interface between USGS and the Master Environmental Library (MEL).

Under Phase I, ERC/IDSL provided software that included the following features:

- Read, help edit, and save a text document in XML Version 1.0 with an external DTD.
- Support DTD optionality and repeatability rules.
- Validate document and element structures as per DTD specifications.
- Flag mandatory elements.
- Generate forms from the GUI for the creation/editing of XML element structures.
- Group repeatable element structures and navigational controls to help browse and edit.
- Allow specification of the form structure and style via a configuration file.
- Develop a basic widget to help display and edit some common element structures such as text, dates, and time fields.
- Provide appropriate feedback and diagnostic messages to the user.
- Provide instructions for installing and using the document.

The distribution at the end of Phase I was limited to targeted friendly-user groups, under agreed upon conditions. The software was developed in Java using JDK Version 1.1.5. This initial release was tested on Windows 95/NT and SGI Irix 6.2 platforms using the Sun JDK 1.1.5 and the corresponding SGI JDK. This was considered a Beta release and feedback would need to be provided to ERC/IDSL for Phase II development activities, which includes further testing and refinement of the software. However, several new functionalities will also be incorporated including:

- Additional widgets such as multiple text fields and enhanced data/time.
- Limited user support via email and telephone.

- User's manual and on-line hypertext help.
- Support for the Solaris 2.5 platform.
- Additional JDK support if appropriate.

An optional Phase III includes:
- Support for additional XML.
- Multibyte (Unicode) character support.
- New widget types to support other commonly occurring element groups.
- Other features and enhancements that may be needed.

5.2 Establishing a National Geospatial Data Clearinghouse Node at ERC/IDSL

Large amounts of environmental data are presently being collected throughout the Gulf of Mexico region to support various policy decisions by federal, state, and local governments. Federal agencies are under Executive Order to develop metadata in compliance with FGDC standards, and most of the Gulf States are following suit. These agencies are establishing Clearinghouse nodes to serve their metadata and data via the Internet. However, there are also large amounts of data being collected by state, local, and corporate organizations that are not entering the system. Many of these data are presently being collected in a poorly organized manner and are not being fully utilized, as the result of inadequate communications. The project objective was to establish a National Geospatial Data Clearinghouse node, at a minimum of the C3 level at ERC/IDSL to support the GMP. This node will provide search and access capabilities to environmental geospatial data in the Gulf of Mexico region that would not otherwise be accessible via the Internet.

The approach consisted of developing FGDC compliant metadata for selected data sets. The metadata were used as test records in the establishment of a Clearinghouse node at a minimum of the C3 level, located at ERC/IDSL. The node will now be used by the GMP to serve metadata and data for other areas in the Gulf of Mexico region that would not otherwise be available via the Clearinghouse system. The tasks performed by ERC/IDSL included identifying and collecting the geospatial data sets shared through the Clearinghouse. Meetings were held with the scientific staff to analyze the data set structure, and to prepare a requirement document on the searching capabilities. A FGDC Content Standards for Digital Geospatial Metadata compliant metadata structure was prepared to allow Web users to efficiently search for the data sets based on various metadata fields.

After finalizing the metadata structure, ERC/IDSL and the GMP worked together to prepare the metadata records to be imported into the node. Training was also conducted for the key technical staff responsible for metadata record creation.

The server is a dual Pentium Pro processor Micron Vetex MXI server with a RAID (Redundant Array of Inexpensive Disks) system of 16 gigabytes of storage. The system is operated on the Windows NT Server 4.0 operating system. A high capacity Microsoft Internet Information Server 4.0 was installed and configured as the Web server of the Clearinghouse Node. With this hardware/software, ERC/IDSL and GMP established a C3 level node for this project and incorporated International Standards Organization (IS0) Z39.50 as the standard

searching protocol, provided metadata links to retrievable data sets on-line, and provided search of multiple fields and free-text.

Research was also conducted to help decide the actual implementation of the Z39.50 protocol for the Clearinghouse Node. Both freely available and commercial Z39.50 software packages were evaluated to help make the decision. A metadata database was also designed and maintained as the metadata repository of the Clearinghouse node.

Both ERC/IDSL and GMP realized that the success of the Clearinghouse Node largely depends on the amount of data that it can collect and provide. To allow the partners to quickly populate the metadata database, an easy to use metadata wizard is the key. ERC/IDSL designed and developed a Web-based user front end that allows its users to easily construct and submit a metadata record on-line, using one of the compatible Web browsers. This metadata wizard provides the capability for metadata owners to remotely create, update, and delete the metadata records in the Clearinghouse catalog, while maintaining the integrity of the metadata.

6.0 RESEARCH PROJECT WITH THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

6.1 A Distributed Data Warehouse for the Remote Sensing Technologies Center (RSTC)

In this project, IDSL began on 1 July 1999 to provide software engineering and programming support in data management to ERC's Computational Modeling Support Group. Our objective is to design, develop and implement a distributed data storage, management, and distribution system for both remotely sensed and observed geospatial data/metadata, in support of the RSTC.

The RSTC has collected and obtained large volumes of remotely sensed and observed data in support of various projects in agriculture, forestry and wildlife, transportation, computational modeling, and workforce development. Research teams function from geographically distributed locations throughout the State of Mississippi. Hence, it is important not only to provide detailed information about the data (content, quality, availability, etc.), but also to provide timely and easy access to the data. The RSTC Data Warehouse will facilitate the processing, storage, discovery, and timely distribution and exchange of geospatial data. It will use Commercial Off-the-Shelf Software (COTS), Government Off-the-Shelf Software (GOTS), and standards-based technologies such as NASA Data Interchange Format (DIF) and FGDC Content Standard for Digital Geospatial Metadata (CSDGM) for geospatial metadata, Common Object Request Broker Architecture (CORBA) and OpenGIS for distributed architectures, and HDF and SDTS for geospatial data.

7.0 CURRENT FACILITIES AND PERSONNEL

ERC/IDSL software has been developed using Sun Microsystems and Silicon Graphics Inc. workstations and personal computers in a network configuration. The Windows NT, UNIX operating system, and JAVA Software Development Kit are the cornerstones for the system. The

primary computer languages are JAVA, C, C++, Fortran, SGI proprietary GL and/or Open GL, X-Windows client-server model, and the Open Software Foundation's Motif widget set.

ERC/IDSL is heavily invested in state-of-the-art computer hardware including an internal network of Sun Sparc (4's, Ultra 2's, and Quad-Processor Sparc 10's) and SGI Power Challenger Array and Indigo Extreme Graphics workstations, and personal computers. Data storage consists of a Sun Sparc 1000 Fileserver integrated with a 75 gb RAID file system. The network is currently a 10 mb/second LAN that is being upgraded to a 100 mb/second switched environment. We are also in the process of upgrading our connection to the Internet via a commercial T1 line. Remote users may access any systems on-line using the TELNET utility. Hard copy is available from a variety of color and black and white printers. Additionally, all administrative and management staff are integrated into the local area network, utilizing a combination of networked Macintosh and PC desktop computers.

At present, ERC/IDSL consists of fifteen permanent staff members including oceanographers, meteorologists, software engineers, fluid dynamicists, mathematicians, programmers, computer technicians, and administrative personnel. We typically support 10 graduate and undergraduate students per year, and this has included students through the MSU Cooperative Education Program and Computer Science Department, as well as from several other universities including Southern Mississippi, New Orleans, Louisiana Tech, Virginia, South Dakota School of Mines, Oregon State, Louisiana State, Florida State, Brandeis, Tulane, William Carey, South Alabama, and Mississippi Gulf Coast Community College. ERC/IDSL is located in Building 1103 of the Stennis Space Center, a major focal point of science, engineering, and technology efforts with nearly 4,000 employees.

APPENDIX

PROPOSALS SUBMITTED AND CONTRACTS AWARDED

To	Title	Date Submitted	Amount Requested	Amount Awarded
Naval Research Laboratory Environmental Acoustics via Planning Systems, Inc. Slidell, LA	PI: J. Corbin Environmental Acoustics Support - ERC/IDSL is a Subcontractor to PSI	16 May 94	$35,000 per year	No Work Orders issued
Environmental Protection Agency/Gulf of Mexico Program Office Stennis Space Center, MS	PI: R. Passi Software Infrastructure Development of Virtual Data Warehouse	4 Dec 97	$152,784	$152,784 FY 98/99
U.S. Geological Survey Federal Geographic Data Committee NSDI Program Reston, VA	PI: R. Passi MSU ERC/IDSL as a USGS National Geospatial Data Clearing House Node	27 Feb 98	$40,000	$40,000 for FY99
Naval Oceanographic Office (Dr. John Blaha) via the Mississippi Research Consortium and NASA, Stennis Space Center, MS	PI: M.S. Foster MEL Operation and Maintenance Services to Support NOPP Gulf of Mexico Ocean Monitoring System	17 Apr 98	$69,500	$69,500 for FY99
Naval Research Laboratory (Code 7540), Dr. Ted Tsui, Monterey, CA	PI: V. Anantharaj, J. Corbin, J. Chambless, and M. Zhou, Advanced MEL Development FY98-00	5 Jun 98	$60,000	Add-on Funding Surf Zone FY98/99
Naval Research Laboratory (Code 7540), Dr. Ted Tsui, Monterey, CA	PI: V. Anantharaj, J. Corbin, J. Chambless, and M. Zhou, Advanced MEL Development FY98-00	5 Jun 98	$40,000	Add-on Funding Physitron FY98/99
Mississippi EPSCoR Committee Office of Research, Mississippi State, MS	PI: Dietrich and A. Mehra, Design and Implement a Data Assimilating Hindcast, Nowcast and Forecast System for the Gulf of Mexico	29 Jul 98	$333,000	Not awarded to ERC/IDSL
Office of Naval Research Attn: ONR 353 DURIP 800 N. Quincy Street Arlington, VA 22217	PI: J. Corbin Request for Computer Equipment to Support ERC/IDSL Research	29 Jul 98	$157,484	Not awarded to ERC/IDSL
Naval Oceanographic Office via the Mississippi Research Consortium and NASA Stennis Space Center, MS	PI: C. Abbott Naval Interactive Data Analysis System (NIDAS) Maintenance/Upgrades	17 Aug 98	$114,000	$114,000 for FY99

Environmental Protection Agency Gulf of Mexico Program Office Stennis Space Center, MS	PI: R. Passi Software Infrastructure Development of Virtual Data Warehouse	20 Aug 98 Revised Jan 99	$298,000	$208,000 for FY99
U.S. Geological Survey Contracting Officer, 12201 Sunrise Valley, Reston, VA 20192	PI: V. Anantharaj Development of Metadata Collection Software in Java Programming	3 Sep 98	$26,058	$26,058 for FY99
Naval Research Laboratory (Code 7540), Dr. Ted Tsui, Monterey, CA	PI: A. Mehra Modeling via Advanced MEL Development FY98-00	8 Sep 98	$33,028	$33,028 Add-on Funding
Naval Research Laboratory (Code 7540), Dr. Ted Tsui, Monterey, CA	PI: L. Perkins/A. Qiao via Advanced MEL Development FY98-00	8 Sep 98	$9,182	$9,182 Add-on Funding
Naval Research Laboratory (Code 7540), Dr. Ted Tsui, Monterey, CA	PI: L. Perkins/A. Qiao via Advanced MEL Development FY98-00	3 Nov 98	$20,659	RFP Canceled
Office of Research, 1999 Research Initiation Program, Mississippi State, MS	PI: A. Mehra A Nowcast/Forecast System for Gulf of Mexico	16 Nov 98	$9,925	Not awarded to ERC/IDSL
Naval Research Laboratory (Mr. Rick Allard) Monterey, CA	PI: M.S. Foster, Surf Zone Project Datasets via Advanced MEL Development FY98-00	20 Nov 98	$55,200	$55,200 Add-on Funding
Naval Research Laboratory Code (Dr. Ted Tsui), Monterey, CA	PI: V. Anantharaj, J. Corbin, J. Chambless, and M. Zhou Advanced MEL Development FY98-00	18 Dec 98	$3,210,713 Maximum Award FY98-00	$80,000 for FY99 1st Increment
Naval Research Laboratory (Code 7540), Dr. Ted Tsui, Monterey, CA	PI: V. Anantharaj, J. Corbin, J. Chambless, and M. Zhou Advanced MEL Development FY98-00	5 Feb 99	$3,210,713 Maximum Award FY98-00	$137,000 for FY99 2nd Increment
National Ocean Partnership Program via Dr. John Blaha, Naval Oceanographic Office, Stennis Space Center, MS	PI: J. Corbin, V. Anantharaj - A Distributed Ocean Modeling Environment for the Gulf of Mexico	8 Feb 99	$210,000 for FY00	Not awarded to NAV-OCEANO
Naval Oceanographic Office via the Mississippi Research Consortium and NASA, Stennis Space Center, MS	PI: C. Abbott Naval Interactive Data Analysis System (NIDAS) Maintenance and Upgrades for FY99/MIW	9 Jun 99	$90,000	$90,000 for FY00
Environmental Protection Agency/Gulf of Mexico Program Office, Stennis Space Center, MS 39529	PI: R. Passi, M. Zhou - Software Infrastructure Development of Virtual Data Warehouse	21 Jun 99	$30,000	Not Awarded to ERC

Environmental Protection Agency/Gulf of Mexico Program Office, Stennis Space Center, MS	PI: R. Passi, M. Zhou - Software Infrastructure Development of Virtual Data Warehouse	21 Jun 99	$208,000	Not Awarded to ERC
Naval Research Laboratory (Code 7540), Dr. Ted Tsui, Monterey, CA	PI: V. Anantharaj, J. Corbin, J. Chambless, and M. Zhou Advanced MEL Development FY98-00	9 Aug 99	$3,210,713 Maximum Award FY98-00	$10,000 Add-on Funding
Naval Research Laboratory (Code 7540), Dr. Ted Tsui, Monterey, CA	PI: V. Anantharaj, J. Corbin, J. Chambless, and M. Zhou Advanced MEL Development FY98-00	9 Aug 99	$3,210,713 Maximum Award FY98-00	$13,000 Add-on Funding for A. Mehra

For the MSU Academic Year 1998-99, ERC/IDSL received $115,000 in funds from the MSU Vice President for Research to support its operating costs at Stennis Space Center.

PARTICIPATION IN INTERDISCIPLINARY ACTIVITIES

With Mississippi State University:

- The Scientific and Technical Research Center (STRC). Here ERC/IDSL worked closely with Dr. Roy Crochet in the coordination of joint MSU activities at the Stennis Space Center. We also jointly operated a motor vehicle for use at the Stennis Space Center.

- The Research Director's Council. The ERC/IDSL Director was a member of this council.

- The Mississippi Research Consortium. This interaction involved the awarding of three contracts to ERC/IDSL from the Naval Oceanographic Office, issued as NASA delivery orders through the Consortium.

- The Engineering Research Center (ERC). This interaction involved preparations throughout the year for a merge of the Center for Air Sea Technology (CAST) into the ERC on 1 July 1999, as the Integrated Data Systems Laboratory.

- The Department of Engineering. ERC/IDSL employed Mr. Atanu Pal, a Ph.D. student in Computational Engineering.

Other Universities/Academia:

- University of Southern Mississippi Cooperative Education Program. ERC/IDSL employed USM students Mr. Min Zhang, Mr. Mike Zhou, Mr. Rohit Mehra, Ms. Alice Qiao, Mr. Michael Vann, and Mr. Bryan Comstock to assist in software engineering.

- University of Colorado. ERC/IDSL was involved in a collaborative effort with Dr. Lakshmi Kantha to develop a relocatable modeling environment for both tidal and circulation models.

- Florida State University. Dr. Richard Pffefer collaborated with ERC/IDSL to use DieCAST in modeling hurricane interactions on the continental shelf.

- Tulane University. Dr. Boumediene Belkouche collaborated with ERC/IDSL in database research in support of the EPA's Virtual Data Warehouse Project.

- Texas A&M University. Dr. Worth Nowlin collaborated with ERC/IDSL in using DieCAST for general modeling of the Gulf of Mexico.

- Oregon State University. Dr. James Richman worked with ERC/IDSL to develop a Southern Hemisphere version of DieCAST, which has produced excellent results at 1/3-degree resolution.

- Massachusetts Institute for Technology and Canadian Meteorological Center. Dr. Kerry Immanuel collaborated with ERC/IDSL in coupling DieCAST to the Canadian operational meteorological model.

- Dartmouth College. ERC/IDSL collaborated with Dr. Benoit Cushman-Roisin of the Thayer School for Engineering in an ocean modeling initiative.

- Consortium for Oceanographic Research and Education (CORE). ERC/IDSL collaborated with Admiral James Watkins and Dr. Robert Spinrad of this Consortium, whose purpose is to advance the science of oceanography. MSU is a voting member of CORE with the ERC/IDSL Director the MSU representative on the Board of Governors.

Navy:

- Naval Research Laboratory-Stennis Space Center, MS. ERC/IDSL worked with Drs. Steve Piacsek and Ruth Prellor in Arctic Ocean modeling and the coupling of DieCAST to the NRL ice model. Dr. Dietrich also collaborated with Dr. Piacsek in high resolution modeling of the Mediterranean. Drs. Harley Hurlburt and Charles Barron used DieCAST in Gulf of Mexico simulations of the LATEX region. Also, Dr. Cheryl Blaine funded ERC/IDSL's Dr. Mehra to assist in her modeling efforts in the Adriatic Sea.

- Naval Oceanographic Office. ERC/IDSL provided development support for the Naval Interactive Data Analysis System (NIDAS) to this office and Commander Mine Warfare Command. NAVOCEANO in late FY98 initiated a patent for NIDAS with the U.S. Patent Office. Developers include Mr. Steve Haeger of NAVOCEANO and ERC/IDSL's Mr. Jim Corbin, Mr. Dharmesh Krishnamagaru, Mr. Ramesh Krishnamagaru, and Mr. Clifton Abbott.

- Naval Postgraduate School. Dr. Robert Haney collaborated with ERC/IDSL and funded Dr. Dietrich in modeling the California Current (Santa Barbara Channel) using DieCAST. In

addition, Dr. Alvaro Viudez ran DieCAST in the Western Mediterranean to study the dynamics of a major semi-permanent anticyclonic gyre.

Other Federal Government:

- Defense Modeling and Simulation Office. ERC/IDSL worked with several federal government agencies in developing sites for the Master Environmental Library.

- NOAA National Marine Fisheries Service. Dr. David Dietrich worked with this agency and Dr. Pat Tester in DieCAST GOM model algae bloom simulations.

- NOAA Great Lakes Environmental Research Laboratory. Drs. David Schwab, Dmitry Beletsky, and William O'Connor collaborated with ERC/IDSL in conducting simulations of internal Kelvin Waves and coastal upwelling in the Great Lakes.

- Environmental Protection Agency Gulf of Mexico Program Office. ERC/IDSL worked with this Stennis Space Center based-office and received a follow-on research grant to develop software infrastructure for EPA environmental data. Collaboration also was achieved in developing a proposal to the U.S. Geological Survey.

- U.S. Geological Survey. ERC/IDSL was awarded two contracts by this agency for the development of a National Geospatial Data Clearinghouse Node in FY99 and the other for Development of Metadata Collection Software in the Java Programming Language.

Business and Industry:

- Planning Systems, Inc. ERC/IDSL had a five-year subcontract with PSI in Slidell, Louisiana to support the Naval Research Laboratory Environmental Acoustics Program. This contract was awarded in August 1994, but no delivery orders were issued to ERC/IDSL during this period.

- Physitron, Inc. This Huntsville, Alabama based company was a subcontractor to ERC/IDSL for the Master Environmental Library contract with NRL.

- Weather New, Inc. Dr. Zhifan Zhu of this Sunnyvale, California based company was a consultant to ERC/IDSL to modify the Environmental Visualization Software Version 2.0 into functional modules within ERC/IDSL.

- Rela, Inc. Mr. Michael Carpenter of this Boulder, Colorado based company was a consultant to ERC/IDSL to add data assimilation to the DieCAST Model.

International:

- New Zealand Electric Company. This company collaborated and funded Dr. David Dietrich for high resolution modeling studies of Doubtful Sound and other coastal areas of New Zealand using DieCAST.

- Australian Defense Forces Academy. Dr. Cliff Hearn in Canberra collaborated with ERC/IDSL in using DieCAST to run simulations in the Hawaiian Island area. Dr. Michael Laurs, Director of the NOAA Fisheries Laboratory in Honolulu is also using DieCAST as the Hawaiian Regional Model.

- Australian Naval Oceanography and Meteorology Command. Commander Martin Rutherford visited ERC/IDSL and received presentations on the use of DieCAST in the Southwest Pacific, the Relocatable Modeling Environment, NIDAS, and MEL.

- Australian Bureau of Meteorology. Dr. Brian Sanderson in Melbourne collaborated with ERC/IDSL in using DieCAST to run high-resolution simulations in the Australian Current and the Tasman Sea.

- Auckland University. Students, Mr. Oliver Ross and Mr. Eric Soyes, of the School of Environmental and Marine Sciences used and applied DieCAST as a New Zealand Regional Prediction Model.

- Dalhousie University. Dr. Keith Thompson and Dr. Jinju Sheng collaborated with ERC/IDSL to add data assimilation to DieCAST for application in the Gulf of Saint Lawrence and the Grand Banks.

- McGill University. Dr. Charles Lin collaborated with ERC/IDSL in the use of DieCAST for global climate research and convection studies.

- Bedford Institute of Oceanography. Dr. Dan Wright in Nova Scotia employed DieCAST for eddy resolving North Atlantic climate studies.

- Memorial University. Dr. Richard Greatbatch in Newfoundland used DieCAST for high resolution modeling of the Labrador Sea and Newfoundland Bay.

- James Cook University. Dr. Lance Bode collaborated with ERC/IDSL to nest the DieCAST Coral Sea model in a DieCAST Global Ocean model.

- Environment Canada. In February 1996, ERC/IDSL's Senior Research Assistant Mr. Valentine Anantharaj, was assigned to Environment Canada in Vancouver, British Columbia in a collaborative effort to develop the next generation database management tools to support environmental research and operations. Mr. Anantharaj returned from this assignment in early 1999.

- University of Trieste. ERC/IDSL collaborated with Dr. Roberto Purini of Trieste, Italy in ultra-high resolution modeling of the Adriatic Sea. Dr. Dietrich also participated in an Adriatic Sea Modeling Workshop held in Trieste.

- University of New South Wales. Collaboration continued with Dr. Brian Sanderson in Sydney using the Australian Regional Model for studies of subgrid eddy dynamics

- UIB, Palma, Majorca. ERC/IDSL worked with Dr. Joachim Tintore in modeling of the Alboran Sea Region of the Mediterranean.

- University of Otago. ERC/IDSL collaborated with Dr. Stephen Wing in using DieCAST to study sea urchin larvae transport in the New Zealand South Island Fjordland National Park. This collaboration also extended to Dr. Philip Mladinov, Chairman of Marine Sciences, and with Ph.D. candidate Mr. Darryl Coup on DieCAST model applications in Doubtful Sound.

- CSIRO-Australia. ERC/IDSL collaborated with Dr. John McGregor on applying DieCAST to the CSIRO Climate Modeling Program.

- NIWA-New Zealand. ERC/IDSL worked with Dr. Rob Murdock, Director of Physical Oceanography at NIWA on DieCAST applications.

- Government of Bulgaria. ERC/IDSL collaborated with Dr. Emil Stanev in applying the DieCAST Model to the Black Sea.

- Russian Federation. ERC/IDSL collaborated with Drs. Konstantin Korotenko, Director of the Shirshov Institute of Oceanology in Moscow, and Ivan Obshinnikov in using the DieCAST Model in the Black Sea.

RECOGNITION AND AWARDS

To Ming Zhou, ERC/IDSL Employee of the Year Award, 6 February 1999

To ERC/IDSL Staff, Professional Excellence, 6 February 1999

PUBLICATIONS

Dietrich, D.E. and A. Mehra (1999). Direct Convective Adjustment Simulation Using a Vorticity-Selective filter with Application to the Black Sea. MSU CAST Technical Report 1-99, 1 March 1999, 34 pp.

Matthews, J. and M. Zhou (1999). Gulf Aquatic Mortality Response Network (GMNET). MSU ERC Technical Report MSSU-COE-ERC-99-4 and Gulf of Mexico Program Office Technical Report EPA 855-R-99-002, July 1999, 53 pp.

Corbin, J.H. and L.A. Yeske (1999). MSU Center for Air Sea Technology. Marine Resources and History of the Mississippi Gulf Coast, MS Department of Marine Resources, Biloxi, MS.

Bowman, M., D.E. Dietrich, and P. Mladenov (1999). Circulation and Mixing in Doubtful Sound, New Zealand, as Modified by Discharge from the Manapouri Hydroelectric Power Station. Invited Contribution. Coastal Ocean Prediction, Coastal and Estuarine Series, C.N.K. Mooers (ed.), American Geophysical Union, Washington, DC.

Sheng, J., D.G. Wright, R. J. Greatbatch, and D.E. Dietrich (1999). CANDIE: A New Version of the DieCAST Ocean Circulation Model. Journal of Atmosphere and Ocean Technology, 15, 1414-1432.

Yeske, L.A. and J.H. Corbin (1999). FY99 Research Program of the Integrated Data Systems Laboratory. MSU ERC Technical Report MSSU-COE-ERC-99-08, 30 September 1999, 38 pp.

Cubukcu, N., R.L. Pfeffer, and D.E. Dietrich (1999). A Study of the Ocean Influences on a Hurricane Using a Coupled Ocean Model with Bathymetry and Land Contrasts. Journal of Physical Oceanography. (In Press).

Zhu, Z., R.J. Moorhead, and A. Mehra (1999). Statistics of Eddy Dynamics in the NRL Layered Pacific Model Data. Journal of Physical Oceanography. (In Revision).

Dietrich, D.E., R. L. Haney, A. Mehra and S. Piacsek (1999). Comments on "A Method for Improved Representation of Dense Water Spreading over Topography in Geopotential-Coordinate Models." Journal of Physical Oceanography. (In Revision).

Sanderson, B., D.E. Dietrich, and N. Stilgoe (1999). A Numerically Effective Calculation of Sea Water Density. Marine Models Online. (Under Review.)

Mehra, A. and D.E. Dietrich (1999). Sensitivity Studies with the North Atlantic DieCAST Ocean Model. Deep Sea Research Special Issue on Data Assimilation and Model Evaluation Experiments. (Submitted).

Piacsek, S.A., D.E. Dietrich, A. Mehra, R. Purini, and G. Ficca (1999). High Resolution Simulation of the Adriatic Circulation Using Nested Models. Journal of Geophysical Research (Submitted.)

PRESENTATIONS AND DEMONSTRATIONS

Zhou, M. (1998). ERC/IDSL Role in U.S. Geological Survey National Spatial Data Infrastructure (NSDI) Program. Presentation to Federal Geographic Data Committee at NSDI Partnerships Workshop, Charleston, SC, 22 September 1998.

Dietrich, D.E. (1998). The Use of DieCAST in Modeling the Adriatic Sea. Presentation at ONR International Workshop on Oceanography of the Adriatic Sea, Trieste, Italy, 21-25 September 1998.

Passi, R. and M. Zhou (1998). ERC/IDSL Progress and Plans Under EPA/GMPO Research Grant. Presentation to Dr. J. Giattina, Director, EPA/GMPO, Stennis Space Center, MS, 28 October 1998.

Zhou, M. (1998). EPA Virtual Data Warehouse Project. Presentation at EPA Region IV Information Management Meeting, Atlanta, GA, 3 November 1998.

Dietrich, D.E. (1999). Enhanced Direct Convection Simulation Using a Vorticity Selective Filter. Presentation to Los Alamos National Laboratory Ocean/Atmospheric Modelers, Los Alamos, NM, 9 February 1999.

Dietrich, D.E. (1999). Hydrostatic and Non-Hydrostatic Convection Studies with DieCAST. Presentation to Dalhousie University Ocean/Atmospheric Modelers, Montreal, 17 March 1999.

Corbin, J.H., A. Mehra, and Y. Lau (1999). The Relocatable Modeling Environment. Demonstration to Naval Oceanographic Office Code N64 Personnel, Stennis Space Center, MS, 19 March 1999.

Abbot, C. (1999). The Naval Interactive Data Analysis System. Demonstration to Mr. Steve Haeger of the Naval Oceanographic Office and ERC/IDSL Staff, Stennis Space Center, MS, 30 March 1999.

Zhou, M. (1999). National Spatial Data Infrastructure Program Interim Progress Report. Presentation to U.S. Geological Survey NSDI Program Managers, Portland, OR, 18 May 1999.

Corbin, J.H. and A. Mehra (1999). The DieCAST Model, Tides/Relocatable Modeling Environment, and NIDAS. Presentation and Demonstration to CDR Martin Rutherford, CNMOC, Royal Australian Navy, Stennis Space Center, MS, 11 June 1999.

Piacsek, S.A., A. Warn-Varnas, A. Mehra, and D.E. Dietrich (1999). Interannual and Decadel Variability of the GIN/Barents Sea System. Presentation at the European Geophysical Union Annual Meeting, Liege, Belgium, July 1999.

Chukkpalli, G, D. Choi, S.A. Piacsek, A Mehra, and D.E. Dietrich (1999). Parallel Version of the DieCAST Ocean Model, Presentation to Naval Postgraduate School Researchers, Monterey, CA, July 1999.

Dietrich, D.E. (1999). The DieCAST Ocean Modeling System. Presentation to McGill University Ocean Researchers, Montreal, Quebec, Canada, March 1999.

Dietrich, D.E. (1999). The DieCAST Ocean Modeling System. Presentation to Dalhousie University Ocean Researchers, Halifax, Nova Scotia, Canada, April 1999.

Dietrich, D.E. (1999). The DieCAST Ocean Modeling System. Presentation to University of New South Wales Ocean Researchers, Sydney, Australia, May 1999.

Dietrich, D.E. (1999). The DieCAST Ocean Modeling System. Presentation to University of Auckland Ocean Researchers, Auckland, New Zealand, May 1999.

Dietrich, D.E. (1999). The DieCAST Ocean Modeling System. Presentation to Otago University Ocean Researchers, Dunedin, New Zealand, June 1999.

Chambless, J.W. (1999). Advanced Development of the Master Environmental Library. Poster Presentation at MSU ERC-Stennis Ribbon Cutting Ceremony, Stennis Space Center, MS, 10 September 1999.

Zhou, M. (1999). Development of an Environmental Data Infrastructure for the Gulf of Mexico. Poster Presentation at MSU ERC-Stennis Ribbon Cutting Ceremony, Stennis Space Center, MS, 10 September 1999.

Abbott, C. (1999). Naval Interactive Data Analysis System (NIDAS) Development and Maintenance. Poster Presentation at MSU ERC-Stennis Ribbon Cutting Ceremony, Stennis Space Center, MS, 10 September 1999.

Foster, M.S. (1999). Data Distribution Via the Master Environmental Library (MEL) for Navy Surf Zone Operations. Poster Presentation at MSU ERC-Stennis Ribbon Cutting Ceremony, Stennis Space Center, MS, 10 September 1999.

Zhou, M. (1999). Establishing a National Geospatial Data Clearinghouse Node at ERC. Poster Presentation at MSU ERC-Stennis Ribbon Cutting Ceremony, Stennis Space Center, MS, 10 September 1999.

Mehra, A.. (1999). The DieCAST Ocean Model. Poster Presentation at MSU ERC-Stennis Ribbon Cutting Ceremony, Stennis Space Center, MS, 10 September 1999.

Foster, M.S. (1999). Master Environmental Library Implementation for a National Ocean Partnership Program Gulf of Mexico Ocean Monitoring System. Poster Presentation at MSU ERC-Stennis Ribbon Cutting Ceremony, Stennis Space Center, MS, 10 September 1999.

Mehra, A. (1999). METOC Modeling. Poster Presentation at MSU ERC-Stennis Ribbon Cutting Ceremony, Stennis Space Center, MS, 10 September 1999.

OFFICES HELD

The ERC/IDSL Director was appointed to the Board of Governors for the Consortium for Oceanographic Research and Education (CORE) and represented MSU at periodic meetings.

SPONSORED SEMINARS

Name/Institution	Title	Date
Clifton Abbott MSU ERC/IDSL	Demonstration of Naval Interactive Data Analysis System to ERC/IDSL Personnel	26 March 1999 Stennis Space Center, MS
Hasan Jamil MSU ERC	Removing Misconceptions During Exploratory Mining in Large Databases Through Failure Expansion	30 April 1999 Stennis Space Center, MS
Ranjit Passi MSU ERC/IDSL	Optimization of Optimum Interpolation to MSU Engineering Research Center Personnel	24 May 1999 Mississippi State, MS
Benoit Cushman-Roisin Dartmouth College, Thayer School of Engineering	Computing Issues in Oceanography	16 June 1999 Stennis Space Center, MS

OTHER WORKSHOPS AND MEETINGS ATTENDED

Name	Title	Dates/Location
L.A. Yeske	Discussion with Mr. Rick Allard on MEL Surf Zone Project and FY99 Funding	8 October 1998 Stennis Space Center, MS
J.W. Chambless	Discussions with Dr. John Blaha, Mr. Jim Braud, and Mr. Alan Chappel on NOPP MEL Site at NAVOCEANO	14 October 1998 Stennis Space Center, MS
ERC/IDSL Staff	Discussions with Mrs. Ann Bell, MSU Human Resources Management on Health Insurance Open Enrollment	20 October 1998 Stennis Space Center, MS
R.M. Passi	Discussions with Mr. Michael Carpenter, ERC/IDSL Consultant on adding Data Assimilation to DieCAST	20-23 October 1998 Boulder, CO
L.A. Yeske	Attend 40th Anniversary Program of NASA	23 October 1998 Stennis Space Center, MS

R.M. Passi M. Zhou	Discussions with EPA's Dr. Eugene Meier and Mr. James Matthews on FY99 Research	26 October 1998 Stennis Space Center, MS
R.M. Passi M. Zhou	Presentation to Dr. J. Giattina, Director of EPA's SSC Office on Future Research Program	28 October 1998 Stennis Space Center, MS
S. Payne	Discussion with Mr. Chris Murino of FBI Office, Gulfport, on Computer Security	2 November 1998 Stennis Space Center, MS
L.A. Yeske	Discussion with Mr. Keith Long of CHL on Brief to Mississippi State Senate Joint Committee on Appropriations and Environmental Issue	2 November 1998 Stennis Space Center, MS
M. Zhou	Presentation on VDW at EPA Region IV Information Management Meeting	2 November 1998 Atlanta, GA
L.A. Yeske	Attend Mississippi CHL Presentation on SSC Capabilities to Mississippi Senate Members Robert Deering, Joe Stogner, Terry Burton, Tommy Gollott, Scott Cuevas, and staffers	5 November 1998 Stennis Space Center, MS
J.H. Corbin	Discussion with Mr. Rick Allard of NRL on Surf Zone Project Funding	11 November 1998 Stennis Space Center, MS
V. Anantharaj J.W. Chambless S. Bhate	Progress and Planning Meeting on MEL Contract with NRL	17-20 November 1998 Washington, DC
J.H. Corbin L.A. Yeske	Participate in NASA and MSET Contracting Opportunities Workshop	19 November 1998 Stennis Space Center, MS
M. Zhou	Participate in EPA's Telephone Workshop on Bay St. Louis Estuary Project	23 November 1998 Stennis Space Center, MS
L.A. Yeske	Discussion with Mr. Russell Foster, MSU College of Engineering	1 December 1998 Stennis Space Center, MS
D.E. Dietrich	Participate in Fall American Geophysical Union Meeting	7-11 December 1998 Stennis Space Center, MS

D.E. Dietrich	DieCAST Ocean Model User's Workshop with Drs. Jim Richman, Steve Piacsek, and Robert Haney	9 December 1998 Stennis Space Center, MS
J.H. Corbin	Meeting with Dr. Jonathon Pote, Interim MSU Director Centers and Institutes	9 December 1998 Mississippi State, MS
J.H. Corbin	Discussion with Ms. Tina Henson of MSU SPA	9 December 1998 Mississippi State, MS
J.H. Corbin	Discussion with Dr. Don Trotter, Director MSU ERC	9 December 1998 Mississippi State, MS
J.H. Corbin, J.W. Chambless M.S. Foster	Meetings with NRL's Mr. Rick Allard, NAVO's Dr. John Blaha, and Dr. C. Pancake of Oregon State University on FNMOC MEL Data	15-16 December 1998 Stennis Space Center, MS
J.H. Corbin L.A. Yeske	Discussion with USM's Mr. Robert Willems and Don Goff on Usage of Computer Spaces in Building 1103	16 December 1998 Stennis Space Center, MS
J.H. Corbin	Discussion with NAVOCEANO's Dr. John Blaha on FY99 Funding for NOPP GOM Ocean Monitoring System	17 December 1998 Stennis Space Center, MS
J.H. Corbin M. Zhou	Discussions with NAVOCEANO's Dr. John Blaha on FY99 Research Program with EPA	6 January 1999 Stennis Space Center, MS
J.H. Corbin M. Zhou	Discussions with EPA's Dr. Eugene Meier on FY99 Funding	8 January 1999 Stennis Space Center, MS
J.W. Chambless	MEL Planning Meeting with NRL Project Managers	8 January 1999 Monterey, CA
J.H. Corbin L.A. Yeske	Discussion with Drs. Don Trotter and Brad Carter on ERC/IDSL Strategic Plans	14 January 1999 Stennis Space Center, MS
J.H. Corbin L.A. Yeske	Discussion with Dr. Robert Altenkirch, Vice President for Research on Admin Issues	14 January 1999 Stennis Space Center, MS
ERC/IDSL Staff, R. Altenkirch, J. Pote, T. Henson, J. Hunt	ERC/IDSL and STRC Employee Recognition Dinner	6 February 1999 Long Beach, MS

J.H. Corbin M.S. Foster	Discussions with Dr. John Blaha on NAVOCEANO Proposal for NOPP	8 February 1999 Stennis Space Center, MS
D.E. Dietrich	Ocean Modeling Presentation to Los Alamos National Laboratory Modelers	9 February 1999 Los Alamos, NM
J.H. Corbin M. Zhou	Discussions with EPA on Proposed Gulf Mortality Network	10 February 1999 New Orleans, LA
J.H. Corbin	Meeting with Senator Trent Lott, NASA Administrator Daniel Goldin, and SSC Director Roy Estess on Mississippi Space Commerce Initiative	17 February 1999 Stennis Space Center, MS
ERC/IDSL Staff	Director's All Hands Meeting	18 February 1999 Stennis Space Center, MS
J.H. Corbin	Participate in ERC Engineering Affiliate's Week	22-25 February 1999 Mississippi State, MS
J.H. Corbin	Discussions with Drs. Don Trotter and Brad Carter on CWO Initiative	23 February 1999 Mississippi State, MS
J.H. Corbin	Meeting with MSU Director of Institutes and Vice President for Research on CAST Status	24 February 1999 Mississippi State, MS
J.H. Corbin	Participate in Annual Meeting Consortium for Ocean Research and Education	1-3 March 1999 Washington, DC
R.M. Passi	Discussion with EPA's Dr. Eugene Meier on FY00 Funding	8 March 1999 Stennis Space Center, MS
V. Anantharaj J.W. Chambless	Participate in MEL Interim Progress Review Meeting	11 March 1999 Monterey, CA
J.H. Corbin M. Zhou	Discussion with EPA's Dr. Eugene Meier on FY00 Funding	16 March 1999 Stennis Space Center, MS
D.E. Dietrich	Ocean Modeling Presentation to Dalhousie University Ocean and Atmosphere Modelers	17 March 1999 Montreal, Canada
J.H. Corbin	Meeting with NAVOCEANO's Dr. Michael Carron and EPA's Mr. James Matthews on Potential USGS NSDI Collaboration	18 March 1999 Stennis Space Center, MS

J.H. Corbin A. Mehra Y. Lau	Demonstration of Relocatable Modeling Environment to Naval Oceanographic Office	19 March 1999 Stennis Space Center, MS
J.H. Corbin M. Zhou	Meeting on CWO Initiative with MSRC, ERC, and NAVOCEANO Personnel	22-23 March 1999 Mississippi State, MS
J.H. Corbin	Discussion with Dr. Peter Renelli of CHL on MSU Teaching at Gulf Park	29 March 1999 Stennis Space Center, MS
C. Abbott J.H. Corbin	Demonstration of NIDAS to Mr. Steve Haeger and Mr. Kevin McKone of NAVOCEANO, and Lockheed's Ms. Sheri Corbonette, Mr. Kerry Grant, and Mr. Mike Greer	30 March 1999 Stennis Space Center, MS
J.H. Corbin L.A. Yeske	Discussion with Dr. Joe McCaffrey on MSU Climate, Weather, and Oceanography Initiative, and CAST Merger with MSU ERC	9 April 1999 Stennis Space Center, MS
J.H. Corbin	Discussion with Dr. Peter Renelli of CHL on Trent Lott Research Institute	12 April 1999 Stennis Space Center, MS
ERC/IDSL Staff	Introductory Meeting with Drs. Don Trotter, Brad Carter, and Joe McCaffrey on CAST Merger with MSU ERC	12 April 1999 Stennis Space Center, MS
J.H. Corbin L.A. Yeske	Discussions with Drs. Don Trotter, Brad Carter, and Joe McCaffrey on Proposed Budget for Engineering Research Center at Stennis	12 April 1999 Stennis Space Center, MS
M. Zhou	Discussion with EPA's Mr. James Matthews and NAVOCEANO Personnel on NSDI Metadata Link	12 April 1999 Stennis Space Center, MS
J.H. Corbin L.A. Yeske	Discussion with Mr. John Lever of NAVOCEANO on Potential Collaboration on NSF Digital Government RFP and Proposal	21 April 1999 Stennis Space Center, MS
J.H. Corbin	Discussion with Dr. Peter Renelli, CHL, on Education and ERC Merger Issues	21 April 1999 Stennis Space Center, MS

V. Anantharaj A. Mehra	Attend Seminar "Writing Winning Grants" Presented by MSU Office SPA	29 April 1999 Mississippi State, MS
ERC/IDSL Staff	All Hands Meeting with MSU Vice President for Research Dr. Robert Altenkirch on Merger of CAST with ERC	30 April 1999 Stennis Space Center, MS
J.H. Corbin L.A. Yeske	Discussions with Dr. Don Trotter and Dr. Brad Carter on Merger of CAST with ERC	30 April 1999 Stennis Space Center, MS
ERC/IDSL Staff	Discussions, ERC's, Roger King, Sam Russ, Raghu Machiraju, Hasan Jamil, and Robert Moorhead on Future Research	30 April 1999 Stennis Space Center, MS
J.H. Corbin, V. Anantharaj, M.S. Foster, J.W. Chambless, M. Zhou, Y. Lau	Discussion with Mr. Craig Kunitani NRL Project Leader on MEL Future Plans	11-12 May 1999 Stennis Space Center, MS
M. Wilson	Discussion with MSU's Ms. Sandy Williamson on Merger of CAST with ERC	11 May 1999 Stennis Space Center, MS
S. Payne C. Abbott	Discussion with MSU ERC Tom Ritter and Trey Breckenridge on Merger of CAST with ERC	11 May 1999 Stennis Space Center, MS
V. Anantharaj M.S. Foster	Training in EDGE Software by Autometrics, Inc.	17-21 May 1999 Mississippi State, MS
M. Zhou	Participate in U.S. Geological Survey NSDI Interim Progress Review Meeting	18 May 1999 Portland, OR
M. Wilson S. McDaniel	Discussion with MSU's Ms. Sandy Williamson on Merger of CAST with ERC	20-21 May 1999 Mississippi State, MS
J.H. Corbin L.A. Yeske	Discussions with Drs. Don Trotter and Brad Carter on CAST Merger with ERC	24 May 1999 Mississippi State, MS
L.A. Yeske	Discussions with MSU's Ms. Sandy Williamson and Ms. Susan Price on Merger of CAST with ERC	24 May 1999 Mississippi State, MS
J.H. Corbin	Participate in Future ERC Planning Workshop	25 May 1999 Mississippi State, MS
L.A. Yeske	Discussion with Mr. Matt Ronning and Ms. Tina Henson on CAST Merger with ERC	25 May 1999 Mississippi State, MS

L.A. Yeske	Discussion with Ms. Charlene Carroll and Joan Pritchett, on CAST Merger with ERC	25 May 1999 Mississippi State, MS
R. Passi	Participate in EPA/GMP DTIC Meeting	27 May 1999 New Orleans, LA
J.H. Corbin A. Mehra	Discussions with Drs. Don Trotter, Brad Carter, Sam Russ, Joe McCraffrey, Dan Fox, and Robert Moorhead on CWO Initiative	7 June 1999 Mississippi State, MS
S. McDaniel	Banner/Travel Procedures Indoctrination	8 June 1999 Mississippi State, MS
J.H. Corbin	Attended NRL Brief by CDR Martin Rutherford, CNMOC, Royal Australian Navy	10 June 1999 Stennis Space Center, MS
J.H. Corbin A. Mehra M. Zhou V. Anantharaj	Discussions with CDR Martin Rutherford, CNMOC, Royal Australian Navy on DieCAST, Tides/RME, NIDAS, and MEL Projects	11 June 1999 Stennis Space Center, MS
J.H. Corbin S. Payne	Attend CompuMaster Training Course on Macintosh Computers and Software	17-18 June 1999 Mobile, AL
J.H. Corbin M. Zhou L.A. Yeske	Discussion with GMP/EPA's Mr. Hal Lambright on FY00 Funding Issues	30 June 1999 Stennis Space Center, MS
ERC/IDSL Staff	Reception on Termination of CAST as a MSU Research Center	30 June 1999 Stennis Space Center, MS
J.H. Corbin	Discussions with Dr. John Blaha of NAVOCEANO on FY00 Planned Funding	12 July 1999 Stennis Space Center, MS
M. Zhou L.A. Yeske	Discussions with EPA's Dr. Eugene Meier and Mr. Hal Lambright on FY00 Funding	12 July 1999 Stennis Space Center, MS
J.H. Corbin V. Anantharaj J.W. Chambless	MEL Interim Progress Review via Teleconferencing with NRL Program Managers	20 July 1999 Stennis Space Center, MS
J.H. Corbin L.A. Yeske S. McDaniel	Meeting with Ms. Debbie Keagel and Mr. Joe Stewart on United Way Campaign	21 July 1999 Stennis Space Center, MS
S. McDaniel	Attend Stennis Space Center United Way Campaign	22 July 1999 Stennis Space Center, MS
M. Wilson	Discussions with ERC's Ms. Sandy Williamson on Project Budgets and Accounting	26 July 1999 Mississippi State, MS

J.H. Corbin	Attend Brief by Dr. John McGowan of USM on Plans for Operations at SSC	29 July 1999 Stennis Space Center, MS
J.H. Corbin	Discussion with Dr. Peter Ranelli on USM OTR Planning Initiatives	4 August 1999 Stennis Space Center, MS
J.H. Corbin	Attend Quarterly Meeting of NAVOCEANO, NRL and USM on Modeling Gulf of Mexico	5 August 1999 Stennis Space Center, MS
J.H. Corbin	Discussion with Dr. John McGowen and Mr. Don Goff on USM OTR Planning	6 August 1999 Stennis Space Center, MS
J.H. Corbin	Discussion with Mr. Tom Strange of ERIM on Modeling the Northern Gulf of Mexico	9 August 1999 Stennis Space Center, MS
S. Bhate	Attend 26th Annual International SIGGRAPH Conference	9-13 August 1999 Los Angeles, CA
Staff	Director's All Hands Staff Meeting	11 August 1999 Stennis Space Center, MS
M. Zhou	EPA/GMP Virtual GIS Team Meeting	11-12 August 1999 Stennis Space Center, MS
M.S. Foster	Discussion with Mr. Craig Anderson of UNO on Gulf of Mexico Modeling	13 August 1999 Stennis Space Center, MS
J.H. Corbin J. McCaffrey	SURA Planning Workshop for the Marine Sciences	16-17 August 1999 Charleston, SC
L.A. Yeske	Discussion with Dr. Roger King on ERC Remote Sensing Budgets	17 August 1999 Stennis Space Center, MS
R. Passi L.A. Yeske M. Zhou	Discussions with EPA's Dr. Eugene Meier and Staff on CY00 Research	17 August 1999 Stennis Space Center, MS
J. H. Corbin M. Zhou	Discussions with GMPO's Mr. Ward Brewer on Databases	19 August 1999 Stennis Space Center, MS
S. Payne C. Abbott	Attend 8th USENIX Security Symposium	23-26 August 1999 Washington, DC
J. McCaffrey	Attend Chatauqua Alliance 99 Conference	21-24 August 1999 Lexington, KY
J. H. Corbin	Discussion with Dr. Richard Siquig on MEL Progress/Funding	25 August 1999 Monterey, CA
J. W. Chambless	MEL Progress Review Meeting	26-27 August 1999 Monterey, CA

V. Anantharaj	Inprise Application Server Essentials Seminar Series	30-31 August 1999 Houston, TX
J. McCaffrey	ERC Planning and Development Workshop	3 September 1999 Columbus, MS
Staff	Participation in ERC-Stennis Ribbon Cutting Ceremonies	10 September 1999 Stennis Space Center, MS
J. McCaffrey J. H. Corbin L.A. Yeske	Discussions with ERC Personnel on CWO Initiative	14 September 1999 Mississippi State, MS
S. Payne	Training Course on Advanced Troubleshooting, and Upgrading PC's	13-14 September 1999 Gulfport, MS
V. Anantharaj M.S. Foster	Discussions with Roger King on ERC Remote Sensing Project	14 September 1999 Mississippi State, MS
M. Zhou J.W. Chambless C. Abbott A. Mehra	Discussions with Mr. Robert Ratliff, MSU University Affairs, on Research Projects for MSU Publication	14 September 1999 Stennis Space Center, MS
S. Payne C. Abbott	Discussions with MSU ERC's Trey Breckenridge on Computer Systems and Networking	14 September 1999 Stennis Space Center, MS
J. McCaffrey J. H. Corbin	Discussions with the University Technology Resources Advisory Group on Constituent Infrastructure and Support Needs Assessment	15 September 1999 Stennis Space Center, MS
J. McCaffrey J. H. Corbin	Discussions with Dr. Mike Carron of NAVOCEANO on the Northern Gulf Littoral Initiative	16 September 1999 Stennis Space Center, MS
Staff	Combined Federal Campaign/United Way Discussion with IDSL's Ms. Stephanie McDaniel	17 September, 1999 Stennis Space Center, MS
A. Mehra	Distributed Computing Workshop	19-22 September 1999 Tucson, AZ
J. H. Corbin M. Zhou	Discussions with Mr. Ward Brewer on EPA research	23 September 1999 Stennis Space Center, MS
J. McCaffrey J. H. Corbin L. A. Yeske	Discussions with Drs. Don Trotter, Puri Bangalore, Greg Henley, Dan Fox, George Heburn, and Rick Allard MDMEFS Initiative	22 September 1999 Stennis Space Center, MS

M. Wilson S. McDaniel	Discussions with MSU ERC's Ms. Sandy Williamson and Susan Price on Project Accounting	23-24 September 1999 Stennis Space Center, MS
J. H. Corbin M. S. Foster M. Zhou J. W. Chambless	Naval Research Laboratory DEI Prototype Demonstration	29 September 1999 Stennis Space Center, MS

ACKNOWLEDGEMENTS

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